

## CLAIMS

We claim:

1. A method of fabricating a heterostructure device, the method comprising the steps of:  
providing a buffer layer;  
growing a bottom barrier layer on the buffer layer;  
growing a quantum well layer on the bottom barrier layer;  
growing a top barrier layer on the quantum well layer;  
forming a p-doped cap layer on the top barrier layer; and  
etching a portion of the cap layer to form conducting electrons in the quantum well layer  
below the etched portion of the cap layer.
2. The method of claim 1, wherein the buffer layer comprises  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$ , the bottom barrier layer comprises  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$ , the quantum well layer comprises InAs, and the top barrier layer comprises  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$ .
3. The method of claim 1, wherein a smoothing lattice comprising GaSb/AlSb is disposed between the buffer layer and the bottom barrier layer.
4. The method of claim 1, wherein the cap layer comprises no more than one InAs cap layer.
5. The method of claim 1, wherein the step of forming a p-doped cap layer comprises the step of forming alternating layers of p-doped material having differing  $E_f^s$  values.
6. The method of claim 1, wherein the cap layer comprises a first InAs cap layer, an  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$  cap layer and a second InAs cap layer.
7. The method of claim 6, wherein the etching step comprises etching the second InAs cap layer.
8. The method of claim 7, wherein the etching is performed using a solution comprising acetic acid, hydrogen peroxide, and water.

9. The method of claim 7, wherein the etching step further comprises etching portions of the  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$  cap layer and the first InAs cap layer.
10. The method of claim 9, wherein the etching of the  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$  cap layer is performed using either a solution comprising hydrofluoric acid, hydrogen peroxide, and lactic acid or a solution comprising AZ400K and water, and the etching of the first InAs cap layer is performed using a solution comprising acetic acid, hydrogen peroxide and water.
11. A method of etching comprising the steps of:  
providing a heterostructure;  
providing an etchant solution comprising acetic acid, hydrogen peroxide, and water; and  
contacting the etchant solution to the heterostructure to etch the heterostructure.
12. The method of claim 11, wherein the heterostructure comprises InAs.
13. The method of claim 11, wherein the ratios of the acetic acid, hydrogen peroxide, and water in the etchant solution are from about 5:10:100 to about 5:10:200 by volume.
14. A method of etching comprising the steps of:  
providing a heterostructure;  
providing an etchant solution comprising hydrofluoric acid, hydrogen peroxide, and lactic acid; and  
contacting the etchant solution to the heterostructure to etch the heterostructure.
15. The method of claim 14, wherein the heterostructure comprises  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$ .
16. The method of claim 14, wherein the ratios of the hydrofluoric acid, hydrogen peroxide, and lactic acid in the etchant solution are from about 5:10:100 to about 5:10:200 by volume.

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17. A method of etching  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$  comprising the steps of:  
providing an  $\text{Al}_x\text{Ga}_{1-x}\text{Sb}$  heterostructure;  
providing an etchant solution comprising AZ400K and water; and  
contacting the etchant solution to the heterostructure to etch the heterostructure.
18. The method of claim 17, wherein the ratio of the AZ400K and water in the etchant solution is about 1:4 by weight.